PROCEEDINGS OF THE SEA GRANT SEMINAR AND WORKSHOP ON COASTAL LIVING RESOURCES IN MALAYSIA

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* The various recommendations are the combined contributions of the workshops and the review, enhancement, and adoption in a plenary session.

1. OPENING CEREMONY SPEECHES

WELCOME ADDRESS BY PROFESSOR DR. NAYAN BIN ARIFFIN, VICE CHANCELLOR, UNIVERSITI PERTANIAN MALAYSIA SERDANG, SELANGOR, MALAYSIA.

Terlebih dahulu saya ingin mengambil kesempatan ini, bagi pihak Universiti Pertanian Malaysia, mengucapkan ribuan terima kasih kepada Y.B. Dato Abdul Manan Othman, Menteri Pertanian atas kesudiannya meluangkan masa untuk bersama-sama kita di majlis pada pagi ini, serta sudi pula berucap sepatah dua kata dan seterusnya merasmikan pembukaan seminar ini meskipun kita sedar bahawa beliau sentiasa sibuk dengan tugas-tugas negara.

Kehadiran Y.B. Dato pagi ini, merupakan satu penghormatan kepada kami serta sokongan terhadap usaha yang diambil bagi memajukan lagi sektor pertanian, khususnya industri perikanan.

Saya juga ingin mengambil kesempatan ini mengucapkan tahniah kepada Fakulti Perikanan dan Sains Samudra, Universiti Pertanian Malaysia kerana telah berjaya menganjurkan seminar ini dengan kerja-sama University of Rhode Island.

Ladies and gentlemen,

It is with great pleasure that I welcome you to this off-the-beaten track campus and to the Seminar and Workshop on Living Coastal Resources in Malaysia. Universiti Pertanian Malaysia (UPM) is indeed proud and honoured to have been singled out to be the venue for this important seminar and workshop on a topic that has wide implications but has received scant attention.

This Seminar is of great significance and importance to this region and to Malaysia particularly. As a maritime nation, we are concerned with the optimum but safe utilization and exploitation of our living as well as non-living marine resources. Studies and research on marine resource in Malaysian waters indicate that marine resources off the east coast of Malaysia – Kelantan, Trengganu and Pahang – have not been fully exploited. Of the number of fishing boats in operation, only 30% are in the east coast while the haul is only 23% compared with catches in other parts of Malaysia. With the declaration of the Exclusive Economic Zone, Malaysia will have a sea area of 140,000 square miles – most of which is yet unexploited. Accumulative findings over recent years have shown that our waters are losing out to development – mainly from the indiscrimate disposal of waste into our seas turning them into a gigantic natural sewerage tank. The ocean too is being threatened by uncontrolled and indiscrimate exploitation, and the management of marine resources leaves much to be desired. This concern led to the creation of the Faculty of Fisheries and Marine Science at Universiti Pertanian Malaysia in 1979 as a result of the upgrading of the Division of Fisheries and Marine Science which had been established in 1973.

We at UPM believe that with the aid of current scientific knowledge and technology, the sea could be a viable source of food and nutrition for the population.

The Faculty, on its part, expects to play an active and direct role in national development apart from supplying the much-needed specialists to implement the many projects pertaining to the fishing industry. The Faculty is committed to teaching, research and extension in marine and fishery activities. In this way we hope to contribute our share to national development, human welfare and academic excellence. Faculty research, for example, will focus on those areas that help fishing and related activities; and we will try to initiate new methods or techniques that will bring immediate benefit to the small fishermen or fish farmers.

Research concentration at the Faculty has been in aquaculture and capture fisheries technology that includes navigation, fishing gear technology and seamanship. We hope to impart to the students a general fisheries education in line with the manpower requirements of the country. We pursue a curriculum that is dynamic in the sense that it could be reviewed from time to time to meet the changing and current demands of the country. Though young in age, the Faculty has matured in its academic programme. Programmes up to the Ph.D. level are being offered, and I am glad to note that four students are currently working for this Post-graduate degree.

The facilities on this campus as you will notice during your stay here are limited; but plans are underway to provide more physical facilities to further strengthen the academic programmes of the Faculty. In our main campus at Serdang, the Faculty complex is under construction and will be ready by early next year. The complex will consist of limnology, fisheries, physiology, microbiology and fish disease research laboratiories, an environemtal control room, and a net-loft. There are also plans to set up a fresh water fish hatchery and pond complex. On this campus at Kuala Trengganu, plans for a sea-water system consisting of mariculture laboratory, oceanography laboratories, and a radio isotope laboratory have been finalised. I do hope that the participants at this seminar will give us the benefit of their experience and expertise on the type of sea-water system most suitable for this campus, considering that this project is not only new to us but is also relatively new to the country.

As you are aware this Seminar is organised by the Faculty of Fisheries and Marine Science of UPM and is sponsored by the University of Rhode Island. Our two Institutions have come together in a unique way to further the cause of marine sciences; and this Seminar is the culmination of many years of close co-operation and collaboration. For some time now UPM and the University of Rhode Island have been involved in joint programmes for mutual benefit. Such programmes have taken the form of staff exchange between our two Institutions and joint research projects, several of which are still underway. This spirit of co-operation and the strong bond between our two Universities, separated as we are by many thousands of nautical miles, is truly exemplary in international relationships and, I would say, worthy of emulation by other Institutions and countries. We are indebted to the Unversity of Rhode Island for its generosity and willingness to participate in this bilateral arrangement in the furtherance of science especially marine science.

I would like to take this opportunity, too, to welcome participants from the local universities, from organisations and agencies in the public as well as the private sector. The attendance at this Seminar, it will be noted, is not large in terms of expertise and scholarship, it is representative of the body of interested and dedicated marine scientists in this highly specialised and increasingly important field of study – the living coastal resources in Malaysia. Judging from the presence of foreign and local experts we have succeeded in bringing together a balanced mix. We hope that the temperate waters of the Atlantic will cool the tropical waters of the Pacific and vice versa; and the resultant temperature will be conducive to a successful Seminar.

This workshop will be an opportunity for all participants to exchange views and deliberate on wide-ranging issues pertaining to the theme of living coastal resources. I hope from the many and varied contributions forthcoming from paper presenters and participants, there will emerge clear trends to indicate the direction future research should take. It is very heartening to note that many renowned scientists in the fields of Fishery Economics, fish population dynamics, oceanography, and Fisheries have come together

to discuss their findings and suggest the directions on-going co-operation in the fields of fisheries research, mangrove and coastal ecosystem research as well as fisheries education should take. We at UPM will look forward to the findings and resolutions of the Seminar. We also look forward to continued collaboration with the University of Rhode of Island and trust that from this Seminar new directions for more collaboration among Malaysian marine scientists and economists will emerge. The time is ripe for all those interested in the implications of living coastal resources in Malaysia to come together and actively collaborate towards the achievement of set goals which will benefit our country.

In conclusion, I would like to express the wish that this Seminar will be the first in a series where interested participants will be able to address themselves to pressing problems that pertain to the marine environment of our country; and eventually together contribute to raising, not only the level of marine science scholarship in this country but also, more importantly, help raise the socio-economic status of those who rely on the sea for a living.

Before I end, I would like once again to thank the University of Rhode Island, for their moral and financial support without which this Seminar would not have materialised.

Tuan-tuan dan Puan-puan,

Sekali lagi saya mengalu-alukan Yang Berhormat Dato ke Kampus UPM Kuala Trengganu. Kepada para peserta sekelian, saya berharap penyertaan di seminar ini akan memberi faedah yang berguna dalam usaha memajukan bidang perikanan dan sains samudra. Walaupun saya sedari bahawa kemudahan-kemudahan yang dapat kami adakan agak terhad, namun saya berharap kehadiran tuan-tuan dan puan-puan di kampus ini akan memberi satu pengalaman yang manis yang mungkin tidak dapat dilupakan.

Saya mengucapkan ribuan terima kasih kepada Pengerusi dan Ahli-ahli Jawatankuasa Penganjur Seminar ini serta juga kepada semua mereka yang terlibat kerana telah sama-sama berganding bahu dalam usaha menjayakan seminar selama empat hari di Kuala Trengganu ini.

Terima kasih.

ADDRESS BY PROFESSOR NIELS RORHOLM, COORDINATOR UNIVERSITY OF RHODE ISLAND SEA GRANT PROGRAM

Yang Berhormat, Dato Abdul Manan Othman, Minister of Agriculture and Professor Nayan Ariffin, Vice Chancellor, University Pertanian Malaysia, Ladies and Gentlemen:

I bring you greetings from the University of Rhode Island and best wishes for a outcome of the Seminar. In fact, we bring you more than that. We bring a group of able professionals, eager to discuss with you the results of their work and of yours.

We, at the University of Rhode Island are appreciative of the opportunities for expanded professional cooperation which has grown out of the International Sea Grant Programe. The Sea Grant ideal of encouraging university faculties to address marine problems that are important to business, industry, and government has, in this manner, achieved yet another dimension – cooperation among universities internationally.

The mutual involvement of faculty from four universities – your Universiti Pertanian Malaysia, Universiti Sains Malaysia, and Universiti Malaya, and our University of Rhode Island – is going to have significant consequences both here and in Rhode Island. It will make better teachers and rescarchers out of those of our people who have been involved, we hope it will directly and indirectly lead to better decisions about coastal use and development wherever the participants do their work, and finally, but perhaps most importantly, the students who have been involved will approach their future work with a better understanding of the way their chosen field contributes to the general welfare through wiser use of our natural resources, be they fish or coastal lands.

Finally, a word about the most difficult level of cooperation of all, cooperation among disciplines. No single scientific discipline holds the answer to any important resource problems today. We have already asked too much of individual disciplines. For example, economists, biologists, engineers, food scientists, and technically competent practitioners must together seek better fisheries management schemes. They must then interpret their findings to public decision makers so policies can reflect the knowledge gained. Further, they must monitor the outcome to see where corrections need to be made. They must do these things in full cooperation with public officials, and this is hard for both parties to do.

We believe the Sea Grant approach has made this more nearly possible and I believe that the sort of inter-university cooperation that has led to this Seminar is an excellent beginning. I hope it does not end there. We must see that it is more than a beginning.

We thank the Malaysian University leaders and the government officials for making possible the contributions from faculty and student participants at three of your universities. I am looking forward to the Seminar.

OPENING ADDRESS BY Y.B. DATO ABDUL MANAN BIN OTHMAN, MINISTER OF AGRICULTURE

Ladies and Gentlemen,

Firstly I would like to thank Universiti Pertanian Malaysia and the University of Rhode Island for inviting me to declare opeh the Sea Grant Seminar and Workshop on Coastal Living Resources in Malaysia which they have jointly sponsored. Their effort in holding such a seminar, on such a crucial issue or theme, is certainly a major and significant contribution to our knowledge and consciousness. Personally, I think the significance of the theme is far greater than just to pander to man's utilitarian need or to identify further areas for his exploitation. I am of the humble opinion that it is hightime for man to examine closely, philosophicaly as well as scientifically, his relationship with nature. Since the Industrial Revolution, it is no exageration for me to say that man's relationship with nature has changed drastically. He does not consider himself to be part of nature but more as the conqueror of it. More and more he is forgetting the fact that he is still very much dependend on nature. His callous exploitation of nature has created many problems. This seminar can help us greatly by reminding us once again that we have to live harmoniously with nature and that man must reap from nature without destroying it irrevocably. Perhaps it is relevant for me to remind us of Ghandi's reminder that the earth can cater for everyone's needs but not for everyone's greed. Therefore defining man's relationship to nature, his proper utilization of it and the definition of proper limits are indeed critical issues of our time and our survival may very well depend on our reaction to them.

It is gratifying to note that this workshop has attracted a wide range of professionals drawn from several parts of the world. It is with this exchange of experience and ideas that some, if not all, of the critical issues in coastal resources management can be resolved. I do not intend here, to dictate the course of the workshop but rather, to throw the challenges that lie ahead, from past experiences gained, in man's endeavour to harness the living resources of the sea meaningfully.

Over 72% of the earth surface area is covered by water, in forms of lakes, rivers, seas and oceans. In many ways, fishing is the most important extractive use of the sea generating harvests of between 8 – 12 billion dollars per annum (A.D. Couper, 1976.) These fishes that are harvested differ from each other in their life history, migratory habits, distribution and responses to environmental changes, including man's intervention.

Traditionally, the exploitation of the sea for food, fur or oil did not damage the aquatic resources nor the enviornment. This stems from two reasons. The primitive methods were hightly selective in their modes of operation and the amount of harvests then was rather limited. Today, with the technological advancements in vessel designs and gears coupled with the use of fish detection devices, man's predatory capabilities have increased to such an extent that the survival of several commercial species of fish has been endangered. The collapse of the Peruvian anchovy industry, the depletion of the salmon, sardine and herring fisheries in the N.W. Pacific and the recent declines in Marine landings in the Straits of Malacca and the inner Gulf of Thailand are some visual short-comings of overexploiting marine resources.

In recent years, another problem of grave concern influencing fish mortality has surfaced – that of pollution. The most serious areas of marine pollution lie in coastal waters into which vast quantities of domestic and industrial wastes are indiscriminately poured from landbased activities. These include non-

degradable materials, persistent heavy metals and toxic substances. The detrimental effects of coastal marine pollution can be seen at various levels such as, the destruction of about 40 million fish in the Rhine in July 1969 due to the spillage of some toxic chemicals, the poisoning of the coastal population on the Japanese island of Minemata by methol-mercury absorbed by shellfish and the loss of 30,000 seabirds on the coast of Denmark in 1972 due to oil spillages (A.H. Joensen 1973).

There is little doubt that in the next decade, the living resources of the sea will continue to be of vital importance to mankind. With the increasing reliance on the sea, we must continously examine the relationship between man and the marine environment, for we know too well that man is the only species capable of systematically destroying an enviornment on which he depends upon, be it land or sea. In fact, the next few decades may be crucial to the future of aquatic production with the quickening pace of all processes, including growth in demand, changes in legal regime, technological advancements and the ever increasing threats of over-fishing and pollution. Aquatic life exists at all depths of the sea but, as you are all well aware, the most productive areas in terms of fish population and species lie in the continental shelf areas. It is in this zone that a maze of activities dominate. These activities range from the exploitation of extractive resources (such as fishes, squids, prawns, water, minerals and chemicals) to those of non-extractive uses of the sea, such as shipping, recreation, military operation and waste disposal. Many of these acitvities can take place simultaneously in the same locality but several of them are incompatible to each other.

In short, the coastal belt is where, thousands of fishermen eke out a living, seaborne traffic is heaviest, pollution from waste disposal is at its worst, concentrations of young marine organisms most susceptible to pollution occur and much of the extraction of sea-bed minerals is now taking place.

The aforesaid issues are some of the complex problems that warrant serious consideration in our attempts to formulate a pragmatic framework for optimising the benefits of the coastal living resources. Other related issues, such as the open access nature of the resource, multiple use possibilities, externalities and the need to maintain the ecological strengths of the environments are no less important and deserve further comment in your deliberations.

I would like to take this opportunity to touch briefly on some aspects of our fishing policy which are relevant to the theme of this workshop. Faced with the problem of dwindling resources, our fishing policy cannot afford to ignore the pressing question of systematic and controlled exploitation of resources. The problem of conservation, regulation and greater respect for our nature is by no means to be dismissed as idyllic or purely academic preoccupations.

Within the context of the Malaysian fishing industry, the coastal waters (less than 12 miles from the shore) are characterised by their high productivity and good accessibility thus supporting about 90% of the fishermen. Moreover, lack of capital, infrastructure, skills and knowledge of resources outside this area tend to restrict fishing operations to these coastal waters.

The single most important event in the past 15 years in the fishing industry is the large scale introduction of trawl fishing in the coastal areas. The gear proved to be so effective that it accounts for 56% of total fish landings and was mainly responsible for the rapid increase in fish production in the 60s. However, this large scale development has seriously aggravated the problem of overfishing. The fish landings began to show an increasing higher percentage of trash fish which comprised of quality fish caught before they could grow to adult size and reproduce, as well as the less consumable food fish. Prior to 1966, 16% of total fish landings were made up of trash fish but the latest situation show that the percentage of trash fish caught has risen to 33%. This trend together with rapid increase in fishing efforts caused a further decline in catch per unit effort, meaning that on the average fishing boats are catching less fish.

This uncontrolled fishing, especially trawling will have serious consequences on the ability of the resource to produce maximum biological yield on a sustained basis, and also damage the resources to an extent which would require many years to re-establish itself. Other than the effects mentioned above, trawling has also caused the decline of catch rates of traditional fishing gears and consequently the incomes of fishermen.

As there is no room for increasing fish output especially on the West Coast of Peninsular Malaysia, it is important that the development of coastal fisheries be directed towards the management and conservation of resources against present and potential over exploitation and to safeguard the interests of small scale traditional fishermen in the industry.

In order to reduce fishing efforts in over-exploited coastal areas and to conserve and manage its resources, a new licensing policy was introduced and is being adopted at present. The objectives of the New Licensing Policy are as follows:-

(i) maintaining the resources to achieve optimum yield;

(ii) allocate the resources between industrial i.e. trawler and purse-seiner fishermen and small scale traditional fishermen;

(iii) to reserve the inshore fishing areas to owner-operators;

In order to achieve the above objectives, the following strategies are adopted:-

Four fishing zones in the coastal and off-shore fishing areas have been established. The coastal waters are demarcated into 2 zones:-

Zone A – less than 5 miles from the shore reserved for small-scale traditional gears.

Zone B – Beyond 5 miles and less than 12 miles the owner-operated boats of pukat jerut and trawlers less than 40 GRT.

It is hoped that the regulation of competition between the small-scale fishermen and the trawlers would help to replenish the resources as well as increase the income of the fishermen.

The number of licences issued annually will be based on the resource potential as well as socio-economic and political factors but as far as possible would not exceed the maximum sustainable yield. Although there is a immediate need for reduction of the present total number of fishing units in the inshore areas, it is obviously difficult to do so since this may involve social dislocation and displacement. Therefore it is only possible to limit the number of licences to the current quota issued while new entry should be confined to the off-shore areas. However, the number of licences issued would be reviewed annually in accordance with the optimum fishing effort and availability of resource. Therefore there is a need for constant monitoring of the resource through collection of biological information, commercial fish statistics and exploratory surveys.

The mesh size of 1½ inches and 1 inch cod-end is considered the optimum mesh size for trawl fisheries and shrimp trawls respectively. These recommended mesh sizes would reduce the rate of capture of juvenile fish of commercially important species and shrimp by trawlers. However, the enforcement of the above mesh sizes is posponed until June 1982 as research on its operation is still being carried out.

As a result of the New Licensing Policy, a number of fishermen will be dislocated and a drop in landings in trawl fisheries will occur. To counter the above adverse affects, off-shore fishing beyond 12 miles will be encouraged in order to minimise the impact of the banning of trawling within 5 miles from the shore and to increase production to meet the national demand. Moreover, with the extended national jurisdiction over the newly acquired Exclusive Economic Zone, the off-shore resources present one of the most important opportunities and challenges to develop.

However, it is recognised that there are several constraints to be overcome before such developments could commence. The high costs of capital inputs, lack of experienced manpower, insufficient purposes on commercial scale act as disincentives. As a pre-requisite to the development of off-shore fishing, steps would be taken to make available inputs such as injection of foreign capital, technology and management expertise, infrastructure facilities and suitable credit facilities. Research and exploratory surveys would be carried out to identify extent, denisty and location of fish stocks for exploitation. This is important as future scope of development in this area entirely depends on availability of resources.

Besides promoting off-shore fisheries to offset the adverse effects already mentioned, steps are also being taken to redeploy or relocate the surplus fishermen into aquaculture and land based occupations.

There is a vast potential in aquaculture development in terms of prospects for employment opportunities, income and supply of fish. Surveys would be carried out to identify potential areas and suitable sites. However, problems such as lack of expertise and technology would have to be solved to spear-head its development.

On this note, I end my speech. With great pride, I declare open the Sea Grant Seminar and Workshop on Coastal Living Resources in Malaysia. I hope that the workshop would furnish us with many useful insights capable of guiding us in the proper and meaningful utilization of the natural resources.

2. UNESCO ACTIVITIES IN MARINE SCIENCES

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Introduction

The Unesco Secretariat consists of four sectors: Education, Natural Sciences, Culture, and Communications, dealing with major aspects of programme activity.

Each sector is divided into divisions. The divisions making up the Natural Sciences Sector are: Marine Sciences, Science and Technology Policies, Scientific Research and Higher Education, Earth Sciences, Water Sciences, Technological Research and Higher Education, and finally Ecological Sciences.

Unesco's Intergovernmental Oceanographic Commission (IOC) is also housed within the Science Sector. IOC has its own member states, assembly and executive council, obtains part of its funding directly from the governments concerned and operates as a semi autonomous body within the Science Sector of Unesco.

Marine Sciences in general are covered by both the Division of Marine Sciences and IOC. The Divison of Ecological Sciences further assists in marine science matters particularly in the field of coastal ecosystems where the Man and the Biosphere Programme plays a substantial role.

Unesco's activities are carried out under the terms of reference established by the General Conference of Unesco at its regular meetings. The current programme and budget covers the period 1981 – 1983, and was established at the 21st Session in Belgrade.

Programme Activity in Southeast Asia and Western Pacific

The Intergovernmental Oceanographic Commission (IOC) implements activities established by its Assembly and its Executive Council. Within the framework of the Long-term and Expanded Programme of Oceanic Exploration and Research, the Commission directs ten marine scientific research programmes (four global and six regional), three ocean services programmes including expanding activities in the field of transfer of knowledge and technology through information management, and a broad programme in training, education and mutual assistance.

Emphasis is placed on programmes to climatic changes and the ocean, and on living and mineral marine resources.

The Commission's major programmes relevant to this region include activities in both Southeast Asia and the Western Pacific, including the Tsunami Warning System in the Pacific. When regional projects are drawn up the participation of interested Member States is determined and resulting activities are characterized by close co-operation between the Unesco Regional Offices for Science and Technology and the IOC.

The Commission's activities in the Western Pacific were developed on the basis of the decisions of the first session of the Working Group for the Pacific or WESTPAC I. A number of workshops have been held on various subjects, including methodology of marine biology, marine pollution monitoring using commercially exploited shellfish as determinants, geology, geophysics, and mineral resources, in close collaboration with the Committees for Co-ordination of Joint Prospecting for Mineral Resources in Asian and South Pacific Offshore Areas (CCOP and CCOP/SOPAC). A physical oceanographic monitoring programme, as part of the Intergrated Global Ocean Station System (IGOSS), is being developed as an input to the World Climate Programme. A further sessions of the Programme Group for the Western Pacific (WESTPAC) was held in Jakarta, October 1981, and another is planned for Townsville, Australia in 1983. The activities of the Joint CCOP–IOC Working Group on post-IDOE Studies on East Asia Tectonics and Resources (SEATAR) are continuing.

During WESTPAC II, future research programmes together with their Training Educational and Mutual Assistance (TEMA) requirements were planned in four major areas:

(1) Ocean Dynamics and Climate

(2) Marine Biology and Living Resources

(3) Marine Pollution Research and Monitoring

(4) Marine Geology, Geophysics and Non-Living Resources.

The area covering ocean dynamics and climate was considered in two sections. The first covering open ocean dynamics and climate includes a volunteer observing ship programme, an island and coastal station programme, a hydrographic programme and a drift buoy programme. The second section includes a programme involving survey of currents and tides in the coastal and nearshore waters of WESTPAC region and a programme to examine exchange processes and circulation at coral reefs.

Marine biology and living resources research programmes included delineation and assessment of zones of high pelagic and planktonic productivity with investigations of the biology of key species. The assessment of the deliterious effect of man's activities on the environment and living resources of the WESTPAC region by use of coast assessment was also adopted as a WESTPAC programme. The Programme Group urged that member states give particular attention to determining the specific principles necessary for the manipulation of the productivity of natural ecosystems such as estuaries lagoons, bays and reef flats as possible areas for mariculture.

Marine pollution research and monitoring will include co-operation and involvement with IOC's global Marine Pollution Monitoring Programme (MARPOLMON). Additionally, the ad hoc Task Team on Marine Pollution Research and Monitoring Using Commercially Exploited Shellfish as Determinants will continue to develop a programme for the WESTPAC region.

Consideration was also given to the part to be played by the WESTPAC region in contributing to the Integrated Global Ocean Services System (IGOSS). An offer by the Responsible National Oceanographic Data Center (RNODC) for WESTPAC, located in Japan, to produce a Newsletter for information exchange within WESTPAC, was accepted by the programme group.

Projects to enhance the marine science capabilities of developing member states and associated regional co-operation such as the training and research pilot programme on the mangrove ecosystems of Asia and Oceania, the IOC/WESTPAC sub-regional (Southeast Asia) project on marine science for development (preparatory phase) and the project proposal for the Tsunami Warning System in the Pacific were also considered.

On a global scale, the IOC's plan for the Global Investigation of Pollution in the Marine Environment (GIPME) provides an international scientific framework to co-ordinate national and regional efforts and to concentrate them on the establishment of a sound scientific basis for the assessment and regulation of marine pollution problems.

Priority is given to basic studies, conducted on national or regional scales and aimed at building up information on the world-wide distribution of marine pollutants which will serve as a starting-point for future reports on the state of the oceans. Equal weight is attached to research activities dealing with inputs, pathways, sinks, effects, and dose/response relationships of major pollutants in the ocean. Attention is also give to calculations of mass balance and studies of transfer processes between major reservoirs (ocean, atmosphere, organisms, sediment) and to determining the degree and threshold of exposure to pollutants acceptable for man and marine organisms.

The Working Committee for GIPME is concerned with selecting standard methods of sampling and analysis as well as with the development of accurate intercalibration procedures which are needed for effective baseline or monitoring programmes. Programmes of monitoring marine pollution in coastal waters, as well as background levels of selected pollutants in open-ocean waters and also monitoring of ocean pollution by petroleum hydrocarbons (MARPOLMON) are given particular attention, in close collaboration with the Regional Seas Programme of the United Nations Environment Programme (UNEP).

The Integrated Global Ocean Station System (IGOSS) is jointly sponsored by IOC and WMO, and comprises an operational system whereby real-time oceanic data in the form of charts, data plots, etc. are prepared and issued to a wide spectrum of maritime users in the fields of research, engineering, shipping and fisheries, as well as to weather forecasting services for the general public.

The IOC's Tsunami Warning System in the Pacific is the international arm of the United States National Tsunami Warning System operating from Honolulu, Hawaii. It consists of a number of seismological and tidal stations, located around the Pacific Ocean and on islands. The eighth session of the International Co-ordination Group for the Tsunami Warning System in the Pacific was held in Suva, Fiji, from 13–17 April 1982.

The Unesco Division of Marine Sciences places special emphasis on: (i) the establishment of programmes of relevance to developing countries in the utilization and management of their marine resources and coastal environments; (ii) the strengthening in these countries of training for specialists and technicians and of marine science infrastructures; and (iii) the co-operation with scientific non-governmental organizations which provides a firm scientific basis for the programme, which in turn establishes a framework for larger extra-budgetary projects in marine sciences.

Most governments are contemplating measures for the management of the resources of their coastal ecosystems. Such management must be based on knowledge of the specific environment and of the consequences of human activities. In most countries, relevent information is lacking. The Unesco Division of Marine Sciences therefore carries out practical research and training projects whose purpose is to collect the information needed and ensure the development of infras-structures and human resources in marine sciences, in the context of a major multidisciplinary programme on the management of coastal ecosystems. This programme involves scientific reviews and investigations on mangroves, coastal lagoons, esturine and coral reef environments and their relationship to offshore zone preparation of syntheses of knowledge on fundamental marine science problems and sea water characteristics, etc.

In Southeast Asia and the Pacific the three most important programmes concern mangrove ecosystems, coral reefs, and training activities.

Mangrove Ecosystems

Development of the principal project in their field the "Training and Research Pilot Programme on the Mangrove Ecosystems of Asia and Oceania" has evolved through various meetings, workshops, consultant missions, research grants, etc.

The "Asia Symposium on Mangrove Environment: Research and Management", convened at the University of Malaya, Kuala Lumpur (25–29 August 1980) and the subsequent meeting of National Mangrove Committees (29 and 30 August 1980) formed the final steps in the development of this programme which started many years ago. The operational project activities, sponsored by UNDP, are expected to start in August 1982.

The mangrove programme emphasizes fundamental research in ecosystem structure and function. Determination of the socio-economic value of the system, its development, required management and protection strategies, short and log term pressures on the system, problems relating to administrative and legal aspects as well as specialized training required are priority considerations.

Coral Reefs

The Division of Marine Sciences has long standing contacts with the coral reef research community. A Scientific Committee on Ocean Research (SCOR)/Unesco Working Group was convened to produce Monograph no. 5 on coral reef research methods in Unesco's series of Monographes in oceanographic methodology.

OCE provided sponsorship to the International Coral Reef Symposium which was convened under the auspices of the Committee on Coral Reefs of the International Association of Biological Oceanography (IABO). More than 600 scientists attended this Symposium, and approximately 280 scholary papers were delivered on sicentific advances in the understanding of coral reef functions and the impact of man on these structures.

The Unesco Workshop on Research and Training priorities for Coral Reef Management, covened on 21 and 22 May in conjunction with the IABO Symposium recommended the establishment of a network of marine research institutes in the Indo-Pacific, the initiation of a regional coral reef management research and training project proposal and the preparation of a coral reef management handbook for middle and upper level managers.

The Division's plans for Asia and the Pacific include the preparation of a Coral Reef Handbook in co-operation with the Great Barrier Reef Marine Parth Authority (GBRMPA), Australia. A contract governing this activity has been drawn up and submitted to GBRMPA for ratification.

Unesco is also investigating the possibility of holding a regional meeting on standardization of coral reef survey methods in 1982 and has commenced work on formalizing a coral reef/marine sciences network for the region. A seminar on the Scientific Aspect of Traditional Management of Coastal Environments will be conducted by Unesco at the XVth Pacific Science Congress, 1–11 February, Dunedin, New Zealand.

Research and Training

Higher standards and increased number of marine scientists in developing Member States are promoted through the provision of fellowships or study grants, and organization of training courses. Emphasis is placed on enhancing research capabilities in fields of marine science where there are obvious shortcomings. Fellowships for periods of up to nine months and study grants for short-term courses are provided to young marine scientists for advanced study. Efforts are being made to introduce the audio-visual course on marine science developed by the United Kingdom Open University, in co-operation with Unesco, into local university curricula in various developing countries. University courses will be developed in applied science fields, such as ocean engineering and fisheries technology.

3. WORKSHOPS

3.1 WORKSHOP ON FISHERIES

3.1.1 Fisheries Science

It was recognised that several presentations at the Sea-Grant Seminar on Coastal Living Resources in Malaysia were related to Fisheries Research. Two areas were considered for discussion at the workshop. These were fishery research survey methodologies and fishery management methods.

Recommendations

(a) In view of the active participation of several Malaysian agencies and institutions in fisheries research, with possible overlap, it is recommended that some formal mechanism for continuing collaboration and information exchange be established. It is also suggested that a central repository for publications and reports related to Malaysian fisheries be established.

(b) Prawns – The high economic importance of Malaysian prawn resources is clearly recognised. Results of seminar presentations on mangrove and coastal environments were not considered sufficiently conclusive to permit making immediate recommendations regarding adverse effects of large scale mangrove and other coastal habitat modifications. It is therefore recommended that there should be continuing and accelereted research on mangrove/prawn relationships.

(c) Research Survey Methodology – Routine resource surveys in coastal waters for demersal stocks do not appear to be further justified. However, it is recommended that carefully planned and executed research sampling surveys of these resources be implemented and continued to provide an adequate time-series data base for the application of new management methodologies. More specifically, surveys should be designed to provide, as a minimum, quarterly time series data of species composition, relative abundance and size frequency distributions. These data would provide the base for application of new management models based on empirical time series analysis.

3.1.2 Fisheries technology

The capture fishery sub group discussed the various immediate and long term problems affecting the industry in line with the theme of the Seminar and the speech of the Minister of Agriculture. From this discussion it was recommended that the following areas be investigated and pursued as important criteria for the development of the industry.

Recommendations

(a) Fishing vessel development – In view of the problems faced by the industry in the attempts to modernize the industry a study is recommended to review and improve the drawings and specifications for boats, suitable for the Malaysian inshore and offshore operations. Such items as power requirements to match boat and gear operations, deck arrangements, and use of G.R.P. wells are among the items that should be considered.

(b) Fish Preservation – A review of the use of ice and other preservation techniques in maintaining fish quality is recommended. Along with these the complimentary problem of the size and quality of fish holds should be considered.

(c) Fishing Gears – An effort should be made to improve the performance of the present active gears with emphasis on efficiency and selectivity. Investigations should also be channelled towards the improvement of passive gears with the view of application in inshore and offshore fisheries. An active gears test tank facility for teaching, research and extension is an invaluable device to supplement full scale observations of the operation by using diving sleds.

(d) Fish Detection Instruments – The present bombardment of literature on fish detection devices has not materialized in a positive contribution to the fishery or the operators. Therefore a review of the present status of fish detection devices; their application and maintenance; and the training of fishermen to use them is recommended.

3.1.3. Fisheries economics

With respect to the recommendations for the economic component of future research, suggestions were made under three sub headings.

Recommendations

(a) Cost and Earnings Research – Cost and earnings research on fishermen communities is essential for the following purposes:

(i) To establish a socio-economic data base on the communities and to identify the extent of poverty among households.

(ii) To provide useful information on the appropiate technology to be adopted for a particular location or fishery.

(iii) To identify populations that need to be siphoned for alternative employment (resettlement schemes etc).

(b) Industrial Organisations – Research should be undertaken:

(i) To evaluate alternative strategies to improve the prices to fishermen.

(ii) On the development or upgrading of existing viable fishery based cottage industries.

(c) Demand Analysis – There is a need for a regular collection of price and quantity data at various levels. Time-series information on ex-vessel, wholesale, and retail prices should be carefully monitored by the implementing agency. University researchers could collaborate on acquiring such information so as to identify the causes and forms of the market imperfections and to draw recommendations.

3.2 WORKSHOP ON MANGROVE AND THE COASTAL ZONE

The workshop group noted:

That development and political pressures to reclaim mangrove areas for aquaculture is great and that different development and utilization schemes presently compete for mangrove coastal zones.

That much of the data needed for the rational management of the mangrove ecosystem is lacking.

That there is an urgent need to establish a direct link between mangroves and coastal fisheries and the degree of dependance.

That ecological information on alternative aquaculture pond development strategies is lackng.

That information on the coral reef ecosystem and its significant contribution to the adjacent fisheries is another serious lack relative to coastal zone management.

That environmental baseline studies of most of the coastal ecosystem are lacking.

Recommendations

(a) (i) That a study be undertaken to see if there if a correlation between prawn landings and mangrove areas in different regions of the country.

(ii) That research be undertaken to establish organic matter and nutrient budgets for the mangrove ecosystem to determine the significance of this input/output into the coastal areas.

(iii) That research be undertaken to determine the organisms benefiting from the organic matter/nutrient output from the mangrove ecosystem.

This is not just an academic exercise. The data is needed to answer the vital question: "How much of the mangroves can be converted for alternate use without affecting the mangrove and adjacent coastal fisheries?"

(b) That a socio-economic study be conducted to determine the dependance of the local populations on mangrove forest resources.

(c) That assessment of alternative aquaculture pond development strategies be undertaken.

(d) That research on the impact of pollutants and pressures of human development on the mangrove and coral reef ecosystem be undertaken.

(e) That environmental baseline studies be undertaken for all the coastal ecosystems in the country.

(f) That environmental cost benefit analysis of competing schemes be undertaken to develop the basis for rational use and management of mangrove and coral reef ecosystems and other coastal zone environments.

(g) That the mangrove and coral reef ecosystems be managed for multiple use.

(h) That the training of research and management personnel is vital and that committees like the National Mangroves Committee (NATMANCOM) should seriously look into this matter.

(i) That efforts be made to make the general public aware of the usefulness of the coastal ecosystem in particular.

(j) That the Malaysian National Mangrove Committee (NATMANCOM) play a more positive role in encouraging research and national management of the mangrove ecosystem. Major users of the mangrove ecosystem like MAJUIKAN should increase their input towards research on the mangrove ecosystem, especially in relation to aquaculture use and its environmental implications.

3.3 WORKSHOP IN FISHERIES AND MARINE RESOURCES EDUCATION

The Workshop began with reports from the different Malaysian universities represented in the workshop, indicating their involvement in Fisheries & Marine Resources education:-

Universiti Pertanian Malaysia

Out of nine faculties and one center, seven faculties are involved in fisheries & marine resource education.

The University is the only institution of higher learning in Malaysia which offers diploma & degree programs in Fisheries. This is offered in the Faculty of Fisheries and Marine Science.

The diploma is a three year program; the degree course is a four year program.

In the first two semesters of both programe students are grounded in the basic sciences, humanities and languages, and from the second year onwards, fisheries and marine science core courses are introduced.

Postgraduate programe (M.Sc. & Ph.D) are also offered.

Present Research priorities are:-

Aquaculture

Marine Science and Marine Biology

Fish Biology (Ecology & Taxonomy)

Fishing Gear Technology.

The Faculty also entertain requests, through the Center for Further Education and Extension, to conduct short intensive courses for private and quasi-government staff on areas such as fish diseases and aquaculture.

In addition to postgraduate programs in the Faculty of Fisheries & Marine Science, the M.Sc (Resource Economics) program with fisheries option is offered by the Faculty of Resource Economics & Agri-Business. A non-dgreee short course in fisheries economics option is also being offered. These are ASEAN regional programs, funded initially by IDRC.

Iniversiti Sains Malaysia

Out of the eleven schools (equivalent to faculties), The School of Biological Science (SBS) is the one most involved in marine education, offering courses in the final year of B.Sc. program with some cooperation with the School of Chemical Sciences (SCS) & School of Physical Sciences (SPS).

Undergraduate and Postgraduate (M.Sc. & Ph.D) programs are offered.

A Diploma course on marine pollution monitoring and control is being planned.

Research interest related to Marine Resources,

in the School of Biologiest Science are as follows:–
Mangrove Ecosystem
Aquaculture
Marine Pollution

in the School of Phyical Science,
Seabed Mining of tin & other metals

in the School of Chemical Science,
Oil Pollution studies

in the Center for Policy Research,
Social Science studies in fishing communities

Universiti Malaya

The Department of Zoology in the Faculty of Science offers courses in Fisheries and Marine Biology to the final year honours program. Occassionally M.Sc. and Ph.D. Courses are offered.

Universiti Kebangsaan Malaysia

Out of the seven faculties and the centers of the University. Only one, the Faculty of Life Sciences, is involved in marine education and only one course is directly related to this, i.e. Taxonomy of Fishes as offered by the Department of Zoology.

With respect to research, no marine resource related studies are being done.

However, the University is looking into the possibility of establishing a marine research station in Sabah.

Recommendations

(a) That the development of a post graduate programme in Marine Resource Economics by the Faculty of Resource Economics and Agri-business in UPM be strongly endorsed.

(b) That Malaysian universities with the appropriate facilities and expertise seriously look further into the offering of courses at the postgraduate level (possibly intensive in-service programmes) in the following areas of marine sciences:

(i) Marine Resource Economics

(ii) Marine Affairs, and Coastal Encivonmental and Ocean Law

(iii) Coastal Zone Management.

(c) That the Government of Malaysia seriously look into the urgent need for the immediate establishment of a national reference museum for aquatic fauna and flora, with functional relationship to the nations universities.

(d) That the Malaysian universities should look into the idea of establishing extra-curricular programs to introduce school children to the marine environment with the aim of creating an early awareness and appreciation for the need of conserving it.

(e) That in developing its extension work, there be a closer link between the Extension Unit of the Department of Fisheries and the universities.

4. ABSTRACTS

POVERTY AND POVERTY - ERADICATION IN THE SMALL — SCALE FISHERIES CONTEXT: SOME CONSIDERATIONS

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Available evidence indicates that inspite of significant growth in the fisheries sector between 1960 until present, the socio-economic position of small-scale traditional fishermen has worsened both in relative and absolute terms. While extensive government programmes have been carried out to develop the sector, it is the largest and better-off fishermen who have greater access to such development programmes but the small and poor fishermen lagged behind. The resultant increases in productivity and production arising from rapid modernisation and mechanization of the fishing industry have not benefited the majority of the traditional fishermen. One clear case in point is the introduction and rapid expansion of trawling on the east coast. The detrimental effects of the unequal distribution of benefits caused by trawling are too well-documented and will not be repeated in this paper. In the final analysis, however, it is clear that progress in the fisheries sector has left many fishermen behind and has tended to increase the incidence of poverty among them.

The Fourth Malaysia Plan, however, notes a decline in the incidence of poverty among the fishermen from 73.2% in 1970 to 45.3% in 1980. The majority of the poor fishermen were located in the east coast, although pockets of poverty could also be found along the west coast of Peninsular Malaysia, especially in Kedah, Selangor and Johor. The socio-economic improvement of the poor fishermen was achieved through various poverty-alleviation measures and programmes, notably the subsidies scheme and MAJUIKAN's fishing projects. Other measures such as land settlement and aquaculture projects also helped to reduce poverty within the group.

It is not the intention of this paper to repudiate or validate the official statistics on poverty in the fisheries sector. Rather, the paper is intended to stimulate deliberations of some major issues relating to poverty and poverty-eradication within the sector. The primary emphasis of this paper is upon fishermen and their families who are living within or at the threshold of absolute poverty. Briefly, the paper is divided into 4 main sections:

(1) A poverty profile of the fishing communities,

(2) An analysis of some of the major problems faced by the poor fishermen,

(3) A critical examination of the major Government poverty-eradication programmes in the sector,

(4) Some broad implication for increasing the effectiveness of poverty-redressal policies specific to the fishermen.

THE POTENTIAL OF THE MALAYSIAN EAST COAST TRAWL FISHERIES, RE-EVALUATED IN THE LIGHT OF CATCHES DURING THE '70s

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The previous estimates of Maximum Sustainable Yield (MSY) for the demersal fish resource of the east coast is approximately 100,000 metric tonnes. However, the demersal fish landings since 1974 fluctuated in the region of 50,000 metric tonnes, which was far below the MSY estimate.

The possibility of overfishing cannot be justified since the catch has never reached the estimated MSY and trawling, which is the main method, exploiting demersal fishes (catching 85% – 92% of the demersal fishes) has only been recently introduced in the east coast. Therefore errors in the estimation of MSY made previously cannot be discounted.

The demersal fish stocks off the east coast, Peninsular Malaysia were reassessed using stock production models. Commercial trawl catch and effort data (1970 – 1979) were used. The result suggests that MSY for trawlable demersal stocks is approximately 35,500 metric tonnes per annum with the estimate of optimum effort depending on the model used: 962 vessels using an exponential model and 836 vessels using a linear model. Based on this estimate, the MSY for the demersal fish stocks of the east coast will be in the region of 38,500 metric tonnes to 42,000 metric tonnes. The regult agrees well with the recent trawl landings (47,439 metric tonnes in 1979 and 33,306 metric tonnes in 1980).

This indicates that the fishery is already operating at the maximum sustainable yield level. The prospects for the expansion of the demersal fisheries in the east coast seems to be bleak and the number of trawling vessels should not be allowed to increase beyond 900.

A MANAGEMENT SYSTEM FOR SHORT-LIVED MARINE RESOURCES WITH APPLICATION TO MALAYSIAN SHRIMP FISHERIES

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A management system designed for making management decisions for important short-lived resources (penaeid shrimp, for example) is described. The system is based on the successive analyses of length frequency information from a single cohort or group of cohorts. The physical configuration is variable. The major system components consist of a data logging device and a small microprocessor. The components may or may not be physically connected. Estimates of vital statistics, such as estimated growth coefficients and mortality rates derived from successive length-frequency samples, can be applied to yield optimization models on an individual species basis.

Three levels of system operation are indicated. The first uses a separate data logger with later off-line analyses for management purposes. The second level of operation would permit automatic computation of static optimum yields based on successive measurement data alone. The third level involves dynamic optimization which includes economic data and implementation on an off-line computer. The versatility and speed of the system is designed to permit intensive management of short-lived species, such as penaeid shrimp, based on the entrance of cohorts into the fishery.

THE BIOLOGY, EXPLOITATION AND MANAGEMENT ISSUES OF THE PRAWN RESOURCE OF THE WEST COAST OF PENINSULAR MALAYSIA.

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Aspects of the prawn's unique biology are considered along with the possible modes of operation of the prawn fishery. In waters off the west coast of Peninsular Malaysia, where in general prawns are continuously recruited into the fishery, the prawn fishery may tend to be "static" or localized. This stiuation is probably aggravated by various factors. Allegations that the prawn resource has declined, or has been depleted, are unfounded. Although the current exploitation of the resource is close to (or has exceeded) the estimated potential yield, the prawn fishery is apparently insensitive to increasing fishing effort. This may be due to: 1) very high fecundity of prawns, 2) reduction in the prerecruit mortality, resulting from the decline of the biomass of potential predators and food competitors, and 3) exisitng trends of exploitation. The latter consists of prawn fishing being largely within a limited area and of prawn fishing by major gears (trawl and bag nets) being carried out during the spring-tide periods. The prawn's unique biology (points 1 and 2 and other features) has important implications on management; however, rational management polices will also have to consider the possible conflicts between the prawn fishery and the fin-fish fishery and other coastal zone resource uses.

SIMPLE METHODS FOR THE MULTIDISCIPLINIARY INVESTIGATION OF TROPICAL MULTISPECIES MULTI-GEAR FISHERIES

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The methodologies which were used in a two year multidisciplinary investigation of the fisheries of San Miguel Bay, Philippines are presented.

Major methods used were:

- socio-economic survey of fishing households to count fishing assets and determine the factors and attitudes which affect sharing systems, the role of women and children, marketing arrangements, and labor mobility
- cost and earnings analysis of major small-scale gears and of the trawlers with which they compete.
- production function estimations to determine factors explaining catch variability among major small-scale gears.
- cost and earnings analysis of major processing activities and determination of marketing margins for fresh and processed products.
- total annual catch estimation derived from numbers of major gears, daily catch per effort by species or group of species and number of days fished per year.
- detailed analysis of length frequency data of selected fish species to extract growth and mortality parameter estimates and yield per recruit analyses to assess impact of mesh sizes.
- miscellaneous low input biological methods to describe prevailing ecological conditions.

The various methods used in this multidisciplinary study are compared to those used by a University of Rhode Island research group in a similar setting in Costa Rica. Recommendations are made regarding appropriateness of certain methodologies for data acquisition and analysis, such as record-keeping or self-enumeration to supplement surveys, multiple rather than single models for stock assessment, and maximum use of historical and secondary data.

It is argued that overly sophisticated models are not necessary in the early stage of analysis in order to improve one's understanding of the fishery or to provide information useful for fisheries management. However, it is concluded that inter-disciplinary monitoring of time-series data on catch, effort, catch composition, costs, earnings, supply and prices, will be necessary if research is to adequately clarify options for management of tropical, multi-species, multi-gear fisheries given alternative management objectives such as economic efficiency, maximum output, maximum employment or equity of income distribution.

A DISCUSSION OF THE ECOSYSTEM YIELD OF CORAL REEF ENVIRONMENTS

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In areas where reefs abound, native population frequently show relatively little preference for harvesting select species and may be satisfied with taking all that is available, utilizing a wide variety of species, types and sizes. Such practices direct attention to the potential "maximum ecosystem yield" as contrasted with concepts of "maximum sustainable yield" derived largely from monospecies or limited multispecies considerations.

So saying we must ask: What do we know about ecosystem yields and what can we hope to learn? Most fully integrated marine systems that are not manipulated, i.e., are not impacted by aquaculture, are in a climax or near climax state. It follows that cumulative respiration, much of it prokaryotic, is likely to fully utilize the cumulative production. To the extent this is true, harvests from such systems are only realized by interceding on the closed cycles. Accordingly, the potential ecosystem yield is the maximum to which harvesting can intercede on such a climax system without: (a) either interfering to the extent of seriously impairing productivity, or (b) causing a shift to some altered ecosystem structure.

One foreseeable means for determining the maximum ecosystem yield (MEY) is through empirical observations of the catch experience.

Early efforts to estimate MEY for coral reefs and adjacent shallows indicated a potential of 4–5 tonnes/km^2/yr. More recent tallies suggest that this will not stand as a generalization, since yields ranging from 1 to 20 tonnes/km^2/yr have been observed. Noting that reef environments are relatively similar with respect to water quality but differ markedly in physiographic features, attention is now being directed toward deriving a yield index linked to physiogrphy. Initially it appears that the relative proportion of high reef is the most important feature and that the higher MEY values occur where the proportion of high reef to lagoon or adjacent shallows is considerably greater than 1.

THE APPLICATION OF TIMED-RELEASE-FLOAT (WEAK LINKED) TO TRAP FISHING INDUSTRY IN MALAYSIA

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Three trials were conducted off the coast of Pulau Kapas, Kuala Trengganu on the accuracy and precision of commercially available corrodable links or 'timed float releases' for submerged buoy. Links with expected dissolution time of 24 hours, 72 hours, and 1 week were tested. Using links with expected dissolution time of 24 hours, the floats were released at a mean time of 20.6 hours, 22.1 hours, and 20.5 hours and ± twice standard error of 0.59 hours, 1.63 hours, and 1.09 hours respectively. Differences in dissolution times within links of 24 hours were not significant ($P > 0.5$). The fastest dissolution time recorded for this link was 18 hours 26 minutes. It was not possible to determine quantitatively the dissolution times for links with the expected dissolution times of 72 hours and 1 week since some of the floats were released at night when visual observation was impossible. The practical application of the foregoing experiments to prevent theft in trap fishery in Malaysia was discussed.

EFFECTS OF COD-END MESH SIZE ON TRAWL BY-CATCH – PRELIMINARY RESULTS

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In comparative fishing trials being conducted on the fishing ground of Trengganu, cod-ends with mesh sizes of 25.4 mm 50.8 mm stretched are being tested with a commercially operated trawl using the closed cod-end method. This experiment was aimed at determining the by-catch characteristics of cod-ends operated at different speeds and length of tows. The application of different cod-ends and other variables were completely randomized to overcome the effects of time of day and depth of water.

Preliminary results of this experiment showed that while 95% of the catch was retained by the 25.4 mm cod-end, 56.2% comprised of trash fish. The 50.4 mm cod-end retained 61% of the catch but only 17.9% of this was made up of trash fish. The utilization of the largeer mesh size cod-end does not result in a loss of commercially valuable catch but may increase it as illustrated in the hypothetical example. This is further supported by the 50% retention length curve and the length composition of the catch of main species.

The nett effect of increasing the cod-end mesh size to an optimum value can be beneficial to the fishermen by making his operation more efficient i.e. less sorting required, less amounts/weights to handle thereby decreasing wear and tear on nets and gear.

As the drag contribution of a filled cod-end has been estimated by previous workers to be 18% – 20% of the total net drag, the larger cod-end mesh size should decrease net drag enabling greater trawl speeds. This will enhance the catch capability of the trawling operation.

Larger mesh size cod-end increases the size/age of first capture allowing more recruits to enter the fishery leading to long term benefits of the fishing industry.

CROSS-SECTIONAL SOCIO-ECONOMIC DATA OF THREE FISHING DISTRICTS IN PENINSULAR MALAYSIA

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The paper reports on a study of about 300 fishing households from Pantai Remis, Port Weld and Kuala Trengganu undertaken in 1979. The sample households reflect the use of a variety of fishing gear and includes both Malay and Chinese fishermen, covering sea-going boat owners, captains and crewmen. The study focusses upon labour use, income distribution, cost and earnings from the various gear types according to race and location. An attempt is also made to analyse the effeciency of the different methods of catching fish. The study ends with an attempt to relate the socio-economic situation of the fishermen with current government policies and programmes geared toward the development of small-scale fishermen.

FISHING VESSEL SAFETY AND ENGINEERING CENTER

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Wherever an artisanal or commercial fishery is operating a need exists for a technical backup dealing with safety, fishing gear and vessel economy problems. Since only a large commercial fishing company can afford a proper level of technical suport, a fisherman's need has to be filled by either a cooperative retaining the services of a consultant, the government creating a technical agency, or a university providing an advisory service.

In the U.S. there are two Fishing Vessel Safety Centers located at universities and supported by federal government grants. One is located at the University of Washington, covering the North West Pacific shores including Alaskan waters and dealing mainly with the tuna and crab fleets. The second one is located at the Univeristy of Rhode Island and covers Northeast Atlantic shores dealing with a very heterogeneous fishing fleet.

The Safety Center at the University of Rhode Island investigates three main problem areas: vessel stability, vessel effectiveness, and vessel safety education. The detailed operations of the Center, which are being developed, include the determination of the stability of individual fishing boats by inclining and rolling tests. Since most of the boats do not possess any drawings, the Center is developing the capability to determine the shape of the underwater part of the hull and to calculate hydrostatic characteristics necessary to determine the basic stability criteria of the vessel. The owner of the fishing boat is then given a simple graph and instructed in the technique of obtaining the roll period of his boat. Using the graph and the roll period he can then determine the stability of the boat under different conditions of loading. Limits of the stability are indicated on the graph so that the captain can see if the boat is in danger under given conditions. A simple instrument is also being developed, based on a pendulum tuned to the dangerous range of roll periods of a given vessel, that will sound an alarm when the boat begins rolling near synchronous conditions.

Another function of the Center is to investigate engineering aspects of fishing boats and gear. The research concentrates on fuel economy, low drag fishing gear, and gear safety. The Department of Ocean Engineering towing tank is used to test models of fishing nets and accompaying net gear in an effort to reduce the drag of the trawling system to a minimum and increase it's catch effectiveness. Investigations of two and three pitch propellers and propellers in nozzles are being conducted to achieve lower fuel consumption.

The education of the fishermen in vessel safety principles is carried out by means of seminars during Fishermen Forums, by pamphlets, and instruction films. The use of a research vessel to demonstrate and teach new techniques for the fishermen is recommended.

THE MALAYSIAN ROLE IN THE WESTPAC MUSSEL WATCH PROGRAMME

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At the Fourth Cooperative Studies of the Kuroshio and Adjacent Regions Symposium, Tokyo, 1979, an ad Hoc WESTPAC (= Western Pacific) Task Team was formed to look into the area of "Marine Pollution Research and Monitoring Using Commercially Exploited Shellfish as Determinants". After compiling country reports from Australia, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Thailand and U.S.S.R., a first session was organized and held in Manila, Philippines between 26–30 January, 1981. Here, a number of recommendations were made with regard to regionalizing certain areas into three zones for the "Mussel Watch Programme". It was agreed that, with regard to the "Mussel Watch Programme" the study of the following heavy metals be carried out in order of priority as follows:

(a) Cd, Cu, Pb, Hg, and Zn

(b) Al, As, Cr, Co, Fe, Mn, Ni, Se and Ag

and subsequently,

(c) chlorinated hydrocarbons (esp. PCB's and DDT) followed by petroleum hydrocarbons

Other recommendations dealt with:

(a) Identification of monitoring species and collection of synoptic data.

(b) Monitoring (i. Natural or "wild" populations, ii. Cultivated populations, iii. Experimental populations established in waters of suspected quality to act as "sentinels of environmental change").

(c) Sampling aim and strategy.

(d) Variability and statistical considerations.

(e) Intercomparability of results among laboratories.

(f) Manual of methods for sample preparation and analysis.

Based on these recommendation, at the Second Session of the IOC Programme Group for Western Pacific (WESTPAC – 11) held in Jakarta, Indonesia, 19–24 October, 1981, it was felt that an expert group should be formed but the continuation of the Ad Hoc Task Team be maintained. At this meeting essentially all the previous recommendations were accepted.

With this overall prespective of the function of the WESTPAC TASK TEAM on the topic being clarified, this paper initially compares the related studies performed with regard to the "Mussel Watch Programme" in this region, including Japan, Taiwan and Thailand. It should be stated here that among the three forementioned countries, the levels of trace metals, persistent pesticides and PCBs were highest in samples from the Gulf of Siam. From the local context, endeavours were made to determine whether there existed any investigations in connection with the "Mussel Watch Programme" in the Malacca Indonesia since she shares a major portion of this coastal zone with Malaysia. It was found that within the Malacca Straits the Department of Environmental Sciences, University of North Sumatra, had an on-going programme of coastal pollution monitoring with 14 predetermined stations. Since this is of great interest to us the relevant information is presented.

Finally, the presentation deal's with pollution monitoring carried out in Malaysian waters. On comparison of analytical data over a period of five years between 1977–1981 it was found that there is an increasing level of trace metals in coastal waters of Penang Island. These data compared with those of the other Asian regions were relatively high, indicating obviously the greater extent of enviornmental contamination of the Malacca Straits. α –, β – and r – BHC, aldrin, dieldrin and p, p'DDE were also detected in water samples around Penang Island and there is a greater tendency of their existence at higher levels in waters on the eastern side of the Island where rapid urbanization is prevalent and there is a direct exposure to the Prai Industrial Estate. However, PCBs were not detectable in 1 liter water samples, which requires future investigation using at least 20 litres of sample water.

The trace metal contents with regard to the "Mussel Watch Programme" using *Perna viridis* Linnaeus, indicated that the amounts in general were somewhat higher than those found in related species of the Asia region. In the Malaysian context, mussels from Klang and Malacca had the highest levels of trace metals. Similarly, on comparising persistent pesticides, PCBs and trace metal contents with those from Singapore waters, the Malaysian counterpart is approximately three times greater. With this overall information, the author proposes 22 possible future monitoring stations in Western Malaysia and 9 in Eastern Malaysia for support and consideration of the WESTPAC and SEA GRANT Programmes of the region.

The author also feels that this biomonitoring system should be given full support to function on a regional and global basis for marine environmental contamination on a systematic and tangible basis. Further, this opportunity is seized to mention that emphasis should be placed on environmental pollution studies with regard to future aquaculture exploitation and the higly productive mangrove and coral reef ecological systems.

PRELIMINARY MIXING DIAGRAM ANALYSIS APPLIED TO AN ESTUARY TRAVERSING A MANGROVE AND ONE THROUGH A RECLAIMED AREA OF THE WEST COAST OF MALAYSIA

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Initial sampling along the course of two west coast Malaysian waterways, one traversing a mangrove swamp, the other passing through reclaimed land that was formerly a mangrove habitat, failed to show marked differences indicative of nitrogen, phosphorous and particulate carbon inputs from the mangrove environment. The mixing diagram analysis thus applied from sampling done during the rainy season in 1979, is being pursued further by scientists at the Universiti Sains Malaysia.

NUTRIENT DYNAMICS IN A MANGROVE CREEK, SUNGEI SEMENTA BESAR

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The concentrations of ammonia, nitrite, nitrate, dissolved organic nitrogen, particulate nitrogen and dissolved inorganic phosphorus were studied during spring and neap tidal periods in Sungei Sementa Besar, a mangrove-fringed creek/estuary north of Kelang. The mean spring water concentrations of NH_4 (2.2 μg at l^{-1}), NO_2 (0.78 μg at l^{-1}), NO_3 (1.3 μg at l^{-1}), DON (15.2 μg at l^{-1}), TON (40.0 μg at l^{-1}), PN (24.8 μg at l^{-1}) and DIP (3.0 μg at l^{-1}) were significantly higher than that during the neaps when tides do not wet most of the mangrove swamp sediment surface. The nutrient concentrations during the flood and the ebbs flows were not significantly different.

MANGROVE LITTERFALL AND ESTUARINE NUTRIENTS

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Evidence for the link between mangrove productivity and coastal fisheries productivity is more circumstantial rather than direct. We cannot say "No mangroves, no prawns": we can only ask.

Our study of litterfall in Matang shows that some ten tonnes of mangrove litter is produced per hectare per year. Some 92.5% of the litter is organic matter and most of the rest mineral nutrients. The fate of both the organic matter and nutrients is not known.

We have also measured and constructed nutrient (NH_3, NO_2, NO_3, particulate phosphate, 'dissolved inorganic phosphate', total dissolved phosphate, and silicate) profiles of a main stream flowing through the Matang mangroves and a small stream through the Sungai Merbok mangroves as well as diurnal changes in nutrient levels.

In general the phosphate levels are very low (e.g. total dissolved phosphate typically around 3 μ M) and close to the limits of detection. Hence variability is high and interpretation difficult.

Silicates show a constant pattern, decreasing (from about 100 μ M) with increasing salinity (to about 20 μ M at the seawater end).

With ammonia, nitrite and nitrate, only nitrite shows a consistant pattern suggesting that mangroves act as a source (up to 0.01 μ M at about 15% – 20% salinity).

It is suggested that it may be more useful to measure nutrient fluxes in order to establish a nutrient budget. Suggestions were solicited for measurement of tidal flows and riverine inputs. It is hoped that with this approach it may be at least possible to quantify the amounts of nutrients and organic matter entering and leaving the mangrove ecosystem, and contribute towards answering the question "No mangroves, no prawns?"

INTERPRETATIONS OF BASIC FOOD SOURCES IN THE MANGROVE ECOSYSTEM AS SUGGESTED BY THE 13 C METHOD

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The ratio of the two stable isotopes fo carbon is a naturally occuring tracer of organic matter. The carbon produced by mangroves has a range of isotope ratios (–28.5 to –24.5°/∞) distinct from that produced by algae in the area (–20.9 to –14.8°/∞). The isotopic ratios of carbon in consumers relfect the ratios of what they eat. The influence of mangrove carbon was most pronounced or organims collected from the mangrove swamps (–28.6 to –15.4°/∞ , mean = –21.6 ± 3.0°/∞), slightly less in animals from the coastal inlets (–27.3 to –16.1, mean = –19.7 ±2.2°/∞), and not detectable in samples collected 2 – 18 km offshore (–19.1 to –13.1°/∞, mean = –16.3 ± 1.1°/∞). Similar trends were found when samples of the same species of fish and shrimp were collected from both the inlets and offshore. Since the isotope ratios in sedimentary and particulate matter showed that mangrove-derived organic carbon was present in the offshore areas, it is likely that this carbon is relatively refractory to metabolism eventhough it is ingested by some consumer species.

COMPARISONS OF SALT MARSH AND MANGROVE PRODUCTIVITY

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Net primary productivity of macrophytes in salt marshes and mangroves have been estimated at 140 – 2596 g C m . 2 yr^{-1} and 233 – 2774 g C m. 2 yr^{-1} respectively. Approximately 60% of the total production in salt marshes is derived from below ground production of roots and rhizomes while no estimates are available for similar production in mangroves. For such environments there are relatively few estimates of production by phytoplankton in the tidal creeks and by benthic algae on the surface of the sediments. Secondary production of common fiddler crabs is in the range 3.76 – 17.52 g C m. 2 yr^{-1} in salt marshes and 1.24 – 6.4 g C m. 2 yr^{-1} in mangroves. Total production by fiddler and grapsid crabs on the mangrove high shore in Selangor (Malaysia) is estimated at 17.12 – 25.12 g C M, 2 yr^{-1}. Production by meiofauna remains unestimated. Although meiofaunal biomass may be relatively small, their annual production may be ten times their biomass. For example, the annual production of meiofauna in an estuarine mudflat in England was estimated 20.17 g C m. 2 yr^{-1}, while macrofaunal production at the same site was only 5.46 g C m. 2 yr^{-1}. Reliable estimates of productivity are essential to our understanding of the functioning of these complex land-water coupled systems.

THE CONSERVATION OF MANGROVE SWAMPS LESSONS FROM SALT MARSH STUDIES

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In contemplating mangroves as a resource one is reminded of the appraisals of salt marshes along the shores of the United States. Among the features commonly mentioned as attributes of both salt marshes and mangrove swamps are the following:

These environments serve as the nursery grounds for important commercial fisheries species. Comment: While few such species actually enter the marsh and mangrove habitats at any stage in their life histories, they do thrive in the waterways traversing these environments; thus, if we are to understand the implied importance of marshes and swamps, we must focus on the extent to which they enrich the adjacent waters, where early stages occur.

These environments contribute basic nutrients to the adjacent estuaries and coastal systems. Comment: Based on N-fization this may apply in the case of nitrogen inputs but phosphorous compounds must be derived from outside sources.

The marshes and the swamps are the source systems for large scale outwelling into coastal waters. Comments: Recently Scott W. Nixon pointed that this assumption as applied to salt marshes may be overstated, while Donald W. Kinsey has shown that outwelling influences may be restricted to waters close inshore. Such assumptions regarding mangrove outwelling have not been reviewed in a comparable manner.

There is a correlation between the extent of marsh and mangrove areas and the fisheries yields off the adjacent coasts. Comment: This is more conjecture than proven; furthemore we have not evaluated the extent of mangrove and swamp areas that may be vital to the fisheries.

In terms of simplified economics, that is in comtemplating immediate returns against projected expenditure and development needs, arguments to save mangroves are constantly challenged and this will continue. Facing this, ecologists will do well to tak stock of what they know and what they do not know. While a continuing faith in the value of natural systems is needed, if this faith is stated without regard to the need for supporting information, the environmenal cause can become very vulnerable. Obviously this calls for more research and considerable care, rather than emotion in interpreting the results.

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